

WAGE DIFFERENTIALS IN THE CZECH AGRICULTURAL SECTOR IN THE PERIOD OF THE 1ST QUARTER 2000 TO THE 3RD QUARTER 2012 AND LABOR PRODUCTIVITY

Marta Grycova, Ing.

Czech University of Life Sciences in Prague, Czech Republic

Abstract

Long lasting wage disparity in agriculture has a negative effect on the number of workers in this sector and thus rural demographic development. The causes of the external income disparities in the agricultural sector according to economic theories have changed over time and currently each determinant of wage disparities in agriculture reaches a significance of various sizes. This paper carries out the calculation of the gross external wage disparities in the agricultural sector compared to the values for the total economy. The main objective of this paper is to estimate the significance of the influence of labor productivity in agriculture, calculated as the ratio of gross value added and total employment in the agricultural sector, on wages in agriculture using linear regression model of the 1st differences of the variables, estimated by ordinary least squares method. One solution could be to increase the labor productivity.

Keywords: Wage disparity, agrarian labor market, agrarian sector, labor productivity

Introduction

average gross monthly nominal wage (average wage) full-time employees equivalent was 24 514 CZK in 3rd quarter of 2012 according to the official statistics of the Czech Statistical Office (CSO). In contrast, in the sector of agriculture, forestry and fishing (the agricultural sector) according to the classification of economic activities NACE (group A) the average salary was only 20,266 CZK. The difference between these values is equal to 4248 CZK in absolute terms and as a percentage the difference is 17.32% of the value of the average wage in the national economy as total. The wage difference for the 1st and 3rd quarter of 2012 of the absolute value of 6174 CZK and the percentage of 25.64% demonstrated the large seasonal fluctuations typical for the agrarian sector (the highest values of the average wage in the agricultural sector usually in the 4th quarter and lowest in the 1st quarter). In 2011, the average wage in agriculture reached 77.9% of the average wage in the overall national economy. Prolonged wage disparity in agriculture has a negative effect on the number of workers in this sector and hence on demographic development in the countryside. In 2011, the employment in the agricultural sector decreased again by 5%. Also in 2011, most employees in the agricultural sector, i.e. 45% of all employees were in the age group 45-49 years. It is necessary to pay attention to this problem because of the irreplaceable role of the agricultural sector in the national economy and in society in general.

Wage disparity between the sectors of the economy is not a new phenomenon. For example, Slichter (1950) calculated the correlation between different sectors. Krueger and Summers (1987) continued in this topic and Krueger and Summers (1988) also tried to explain these wage differences using the matrices of industry characteristics and employees' characteristics. The main part of the work (the linear regression model) is based on the theory of nominal wage determination in the labor market, however, using the average values of the

variables. It is based on standard microeconomic theory assuming a relationship between the wage growth and productivity growth (Speckesser and Meager, 2011).

Main Text

The external wage differences in the agricultural sector compared to the values of the total economy were calculated on the time series of the period 2000 to 2011 for annual data (because only for this period these time series of methodology classification of economic activities CZ NACE are presented in CSO database), and for quarterly data the period of the 1st quarter 2000 to 3rd quarter 2012 downloaded from the CSO database. Subsequently, these data are estimated by the trend models, linear and polynomial (Lewis, 2012, or Kaplan, 2004).

Linear regression model to estimate the linear trend function has the form:

$$\text{Error! Bookmark not defined. } y_t = \alpha t + \beta + u_t \quad (1)$$

where y is wage disparity, t is trend and u is a random variable.

The largest coefficient of determination R^2 for quarterly data reached a polynomial trend function:

$$\text{Error! Bookmark not defined. } y = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + u_t \quad (2)$$

The hypothesis regarding the trend in data time series of wage differentials in the agrarian sector is the increasing trend.

The objective of this work is to estimate the impact of the variable of average labor productivity in the agricultural sector (calculated as a ratio of gross value added in the agricultural sector and total employment in the agricultural sector) on the average wage in the agricultural sector, in a linear regression model in the form of first differences using ordinary least squares (OLS) method (Hansen, 2000, or Gujarati, 2004).

The linear regression model is based on the theory of wage determination in the labor market ($w = MPL * P$, i.e. the nominal wage is equal to the nominal value of the marginal product of labor) and has a simple form of:

$$\text{Error! Bookmark not defined. } y = \alpha_0 + \alpha_1 x_1 + u_t \quad (3)$$

where the dependent variable y is equal to the average wage in the agricultural sector and the explanatory variable x_1 is the average labor productivity in the agricultural sector. The hypothesis of the model is the positive relationship of the average labor productivity compared to the average wage in the agricultural sector (α_1 should be larger than zero). It's a very simplified version of the model used in Carneiro (1998).

The calculation of the wage differences from 2000 to 2011

The highest value of wage differences in the period of 2000 - 2011 was in 2009 (5700 CZK) during the financial and economic crisis, which had a greater impact on the agricultural sector (CZ NACE: A) than the national economy as a whole. The lowest one (2763 CZK) was in the beginning of the monitored period, in 2000. The calculated average wage differences among the agricultural sector and the national economy increased the most (by 26.6%) between the years 2001 and 2002 and decreased the most (by about 5.3%) between the years 2009 and 2010 due to very high levels of wage disparity in 2009, the year of the hardest effect of the economic crisis. The value of the ratio of the average wage in agricultural sector divided by the one in the national economy reached the biggest value in the year 2001 (again due to the business cycle changes) and the lowest level in the year 2003 (maybe thanks to the EU funds and implementation of the EU policies in the pre-accession period). The value of the percentage change (from the previous year) of the ratio increased the most between the years 2009 and 2010 (by 2.4%), again due to a very low value in the

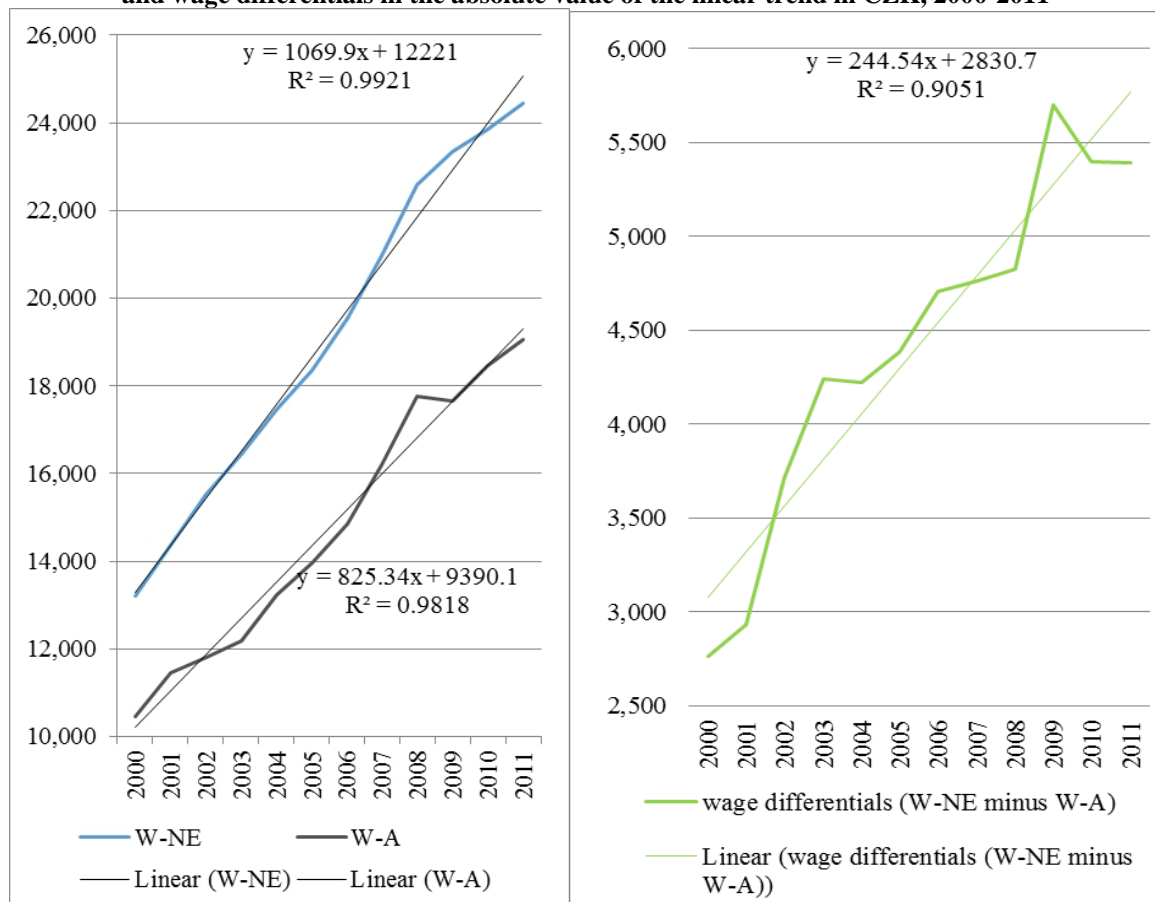
year 2009, the year of economic crisis, and decreased the most between the years 2001 and 2002 (by 4.4%). Table no. 1 describes the wage differences in the selected period in more detail.

Table 1: Average wage (W) in the agricultural sector (W-A) and the total national economy (W-NE), their difference and the average wage in the agricultural sector as a percentage (%) of the average wage in the national economy, 2000 - 2011

	Share of W-A on W-NE in %	Percentage change of the share of W-A on W-NE in %	Nominal wage difference (W-NE minus W-A)	Percentage change of the nominal wage difference in %
2000	79,09827		2 763	
2001	79,61469	0,652886	2 931	6,080347
2002	76,09508	-4,42081	3 711	26,61208
2003	74,18138	-2,51488	4 242	14,30881
2004	75,82732	2,218813	4 222	-0,47148
2005	76,10663	0,368346	4 383	3,813359
2006	75,91323	-0,25412	4 708	7,415013
2007	77,27251	1,790571	4 763	1,168224
2008	78,63403	1,761971	4 827	1,343691
2009	75,58259	-3,88056	5 700	18,08577
2010	77,37596	2,372733	5 399	-5,2807
2011	77,9301	0,716165	5 393	-0,11113

The graph no. 1 describes the evolution of the average wage in the national economy and the agricultural sector with the **linear trend** and the calculated average wage differentials in the absolute value also with the linear trend in the period from 2000 to 2011 using annual data. The linear trend is increasing that is consistent with the hypothesis of this paper.

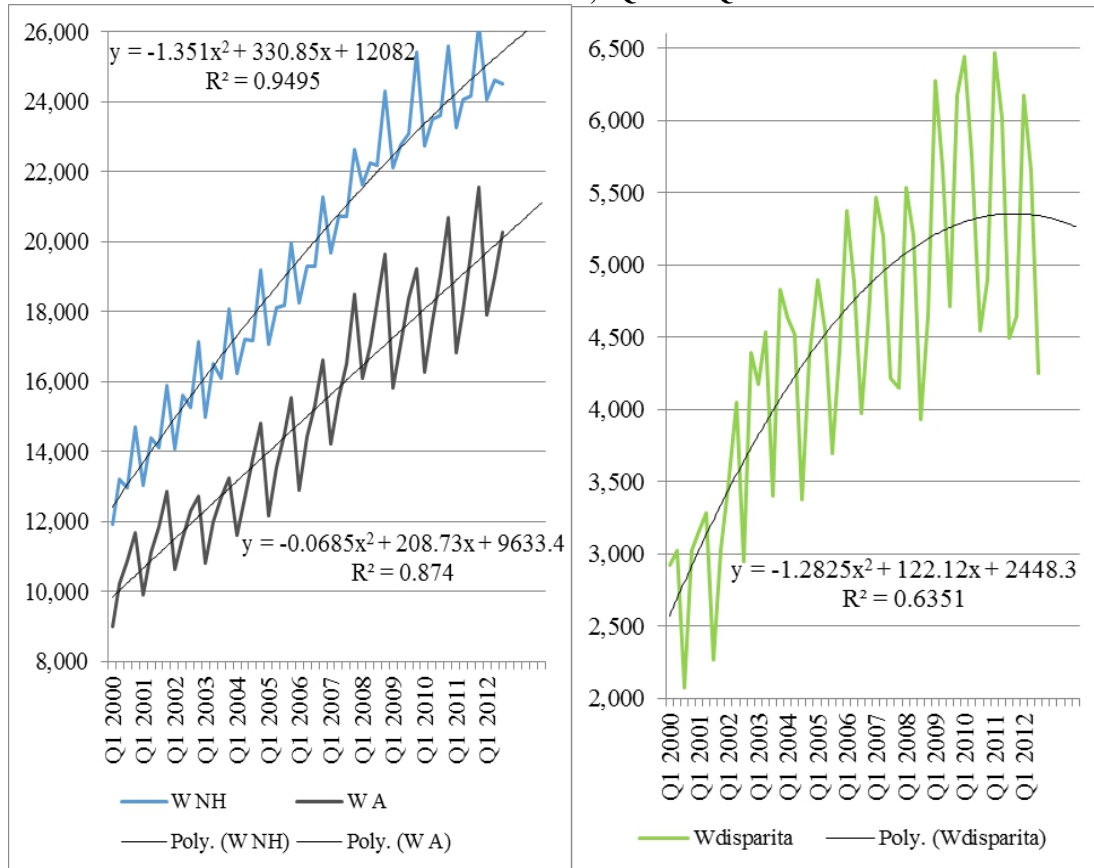
Graph no. 1: The average wage in the national economy and the agricultural sector, with the linear trend and wage differentials in the absolute value of the linear trend in CZK, 2000-2011



Source: data CSO, own elaboration

The graph no. 2 demonstrates the development of the average wage in the national economy and the average wage in the agricultural sector with the polynomial trend of the second degree in the period of the 1st quarter 2000 to the 3rd quarter 2012 using quarterly data. The calculated wage differences among the agricultural sector and the national economy in the absolute value with the second-degree polynomial trend in the period from 1 quarter of 2000 to 3 quarter of 2012 is showed separately. Again the linear trend has an increasing slope (more or less in the second case) that is consistent with the hypothesis of this paper.

Graph no. 2: The average wage in the national economy and the agricultural sector in the second polynomial trend Regulations and wage differentials in the absolute value of the second polynomial trend order in CZK, 1Q2000-3Q2012



Source: data CSO, own elaboration

Results of the linear regression (average wage vs. average labor productivity in agricultural sector)

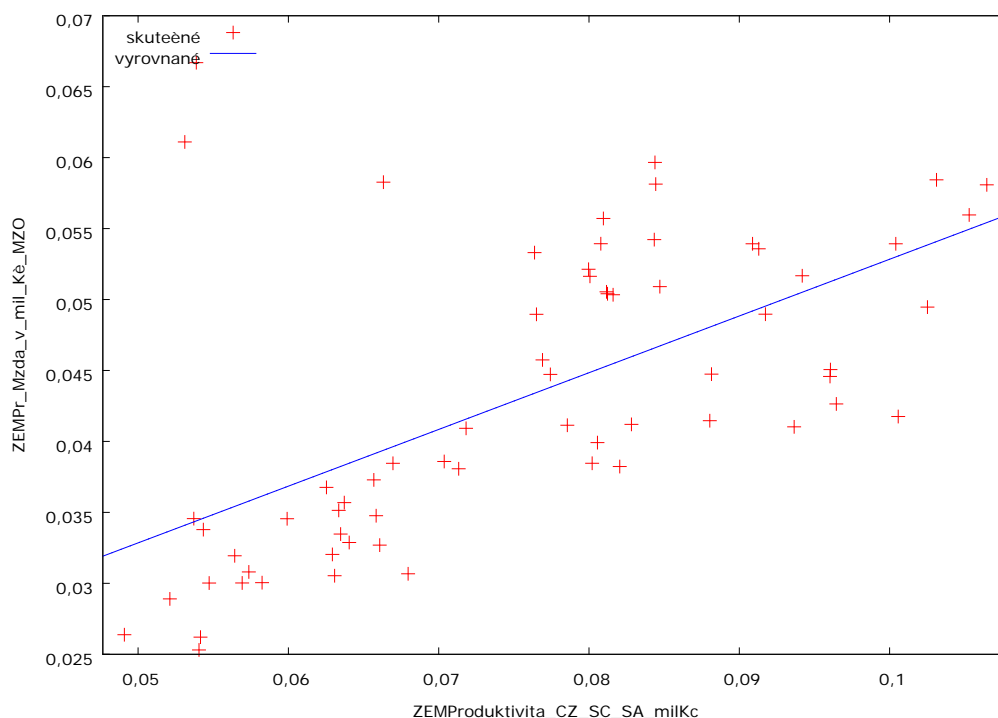
The estimated parameters by OLS method of the linear regression model defined above with average wage in the agricultural sector as an endogenous variable and average labor productivity as an exogenous variable are showed in the following equation:

Error! Bookmark not defined. $y = 0,0129 + 0,3998x_1$ (4)

Thus, a growth in an average product per one employee in agricultural sector of 1 million CZK is connected with an increase of 0.3998 million CZK a year in the average income in the agricultural sector.

Unfortunately, the coefficient of determination of the model was only 0.368849. However, model parameters were statistically significant according to the t-tests. The results are consistent with our hypothesis and economic theory.

Graf no. 3: Regression lines of estimated linear regression of the relationship between the average wage in the agricultural sector (vertical line, in millions CZK), and average labor productivity (horizontal line, in millions CZK), 1996Q1-2012Q2



Source: data CSO, output from Gretl software

Conclusion

The results concerning the average wage differences in the agricultural sector in contrast to the national economy stress the ongoing problem of the Czech agricultural sector.

The difference between the average wage in the national economy and the agricultural sector achieves the highest value during the financial and economic crisis in 2009, suggesting that the crisis burden fell on wages in the agricultural sector more than on the wages in the national economy as a whole. The biggest jumps in the data time series of the percentage change in the ratio of the average wage in the agricultural sector to the average wage in the national economy happened mainly during the economic crisis (negative jumps, i.e. increasing the wage gap) and during the recovery (positive ones, i.e. narrowing the wage gap) contrasting the high value in the crisis with the one during the recovery.

The slopes of the trend lines in both cases for annual data (linear trend function) and for the quarterly data (second-degree polynomial trend function) partially confirm our hypothesis of an increasing trend for wage disparity. Nevertheless, the explanatory power of the estimated trend functions is low due to the short time series.

The results of the linear regression model estimated using the least squares method confirm the hypothesis of a positive impact of average labor productivity to the average wage in the agricultural sector, according to economic theory, but the statistical significance of this model is very low.

This paper tried to contribute to the debate of wage disparities in the agrarian sector. The possible solution to the problem of wage differentials could be to increase the average labor productivity in the agricultural sector, for example by increasing investment in the agricultural sector. However, the explanatory power of the results of the linear regression model is low requiring further and more complex research that incorporates all interconnected variables.

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